

Sick AG

S 7780 – R/Sr

WHAT IS CLAIMED

1. A gas permeable probe for use in an optical analyzer for an exhaust gas stream flowing through a duct or chimney, the probe comprising:
 - an elongate hollow structure having first and second ends and a side wall, with an optical cavity defined between said first and second ends within said side wall,
 - a mounting structure at said first end and adapted for mounting said elongate hollow structure within said duct or chimney,
 - an optical window at said first end permitting a beam of light originating from an optical analyzer to enter into said optical cavity to travel from said first end to said second end,
 - a retroreflector provided at said second end for returning said light beam to said first end of said hollow structure,
 - a filter structure forming a part of said side wall and including at least one filter having a pore size and adapted to permit a gas passing through said duct or chimney to enter into said optical cavity but to prevent particulate matter having particle sizes larger than said pore size from entering said optical cavity,
 - a bellows disposed between one of said first and second ends and said filter structure and
 - a connecting structure connecting said mounting structure at said first end to a support member for said retroreflector at said second end.
2. A gas permeable probe in accordance with claim 1, said optical window at said first end being adapted to transmit out of said opti-

cal cavity substantially all light returned to said first end by said retroreflector at said second end.

3. A permeable probe in accordance with claim 1, said optical window at said first end being adapted to reflect a first portion of the light returned to said first end by said retroreflector back to said retroreflector to obtain a multiple beam path within said optical cavity and to transmit a second portion of said light out of said optical cavity.
4. A gas permeable probe in accordance with claim 1, there being a reflector disposed adjacent said optical window at said first end for returning light returned by said retroreflector back to said retroreflector at least once prior to said light falling on said optical window for transmission out of said optical cavity, whereby a multiple beam path is obtained within said optical cavity.
5. A gas permeable probe in accordance with claim 1, wherein said mounting structure comprises a first mounting flange at said first end of said elongate hollow structure.
6. A gas permeable probe in accordance with claim 5, wherein said connecting structure comprises a plurality of tie members secured to said first mounting flange at said first end and to said support member at said second end.
7. A gas permeable probe in accordance with claim 5, said mounting structure further comprising a support tube connected to said mounting first flange and extending to a second mounting flange adapted for mounting to a wall of said duct or said chimney.

8. A gas permeable probe in accordance with claim 7 and further comprising an inner tube extending between said first mounting flange and said second mounting flange and defining an optical path of known characteristics between said first and second mounting flanges.
9. A gas permeable probe in accordance with claim 8, wherein said inner tube is evacuated.
10. A gas permeable probe in accordance with claim 8, wherein said inner tube contains a neutral gas or a neutral gas mixture, i.e. a gas or gas mixture which does not substantially impair a measurement carried out using said gas permeable probe.
11. A gas permeable probe in accordance with claim 5, wherein said first mounting flange is adapted for the attachment of an optical transmitter and receiver unit of an optical analyzer to said gas permeable probe.
12. A gas permeable probe in accordance with claim 7, wherein said second mounting flange is adapted for the attachment of an optical transmitter and receiver unit of an optical analyzer to said inner tube.
13. A gas permeable probe in accordance with claim 8, wherein said inner tube extends through said second mounting flange to a third mounting flange provided for the attachment of an optical transmitter and receiver unit of an optical analyzer to said gas permeable probe.

14. A gas permeable probe in accordance with claim 8 and further comprising at least one sensor line, at least one gas conducting line and at least one electrical lead, said at least one sensor line, said at least one gas conducting line and said at least one electrical lead being directed through an intermediate space formed between said support tube and said inner tube.
15. A gas permeable probe in accordance with claim 14, said at least one sensor line comprising a temperature sensing line for sensing an operating temperature in the region of said optical cavity.
16. A gas permeable probe in accordance with claim 15, wherein said temperature sensing line extends into a tube provided outside of said elongate hollow structure.
17. A gas permeable probe in accordance with claim 14, wherein said at least one sensor line comprises a pressure sensing line for sensing an operating pressure in the region of said optical cavity.
18. A gas permeable probe in accordance with claim 14, wherein said at least one gas conducting line has an outlet in said optical cavity for directing a calibration gas into said optical cavity.
19. A gas permeable probe in accordance with claim 14, wherein said at least one gas conducting line has an outlet in said optical cavity for directing a neutral gas or a neutral gas mixture into said optical cavity.
20. A gas permeable probe in accordance with claim 14, wherein said at least one gas conducting line has an outlet in said optical cavity for

20. A gas permeable probe in accordance with claim 14, wherein said at least one gas conducting line has an outlet in said optical cavity for directing pressurised gas into said optical cavity to clean said filter of particulate material adhering to an outside of said filter.
21. A gas permeable probe in accordance with claim 20, wherein said gas conducting line extends outside of said filter structure to an orifice provided in said optical cavity at said second end of said elongate hollow structure.
22. A gas permeable probe in accordance with claim 14, wherein said at least one electrical lead is connected to a heater element for said optical window.
23. A gas permeable probe in accordance with claim 14, wherein said at least one electrical lead is connected to a heater element for said retroreflector.
24. A gas permeable probe in accordance with claim 1, wherein said tubular filter structure comprises a tube of filter material having first and second ends with a filter mounting tube at said first end and a filter support tube at said second end, said filter mounting tube being connected to said bellows, said filter support tube being connected to said support member.
25. A gas permeable probe in accordance with claim 1, wherein said tube of filter material comprises one of a filter of sintered metal, a filter of sintered metal coated with a hydrophobic coating, a filter of

ceramic material and a filter of ceramic material with a hydrophobic coating.

26. A gas permeable probe in accordance with claim 1, wherein said hydrophobic coating comprises PTFE.
27. A gas permeable probe in accordance with claim 18, wherein said at least one gas conducting line comprises an inbuilt structure such as a coil spring to ensure turbulence of said calibration gas and contact of said gas with an outer wall of said gas conducting line to heat said calibration gas to a temperature at least substantially equal to the temperature prevailing in said optical cavity.
28. A gas permeable probe in accordance with claim 6, there being first and second tie members arranged spaced apart to form a space between them for receiving said filter structure.
29. A gas permeable probe in accordance with claim 28, each said tie member comprising an elongate metal plate having first and second side edges and first and second tubes extending parallel to said side edges and welded thereto.
30. A gas permeable probe in accordance with claim 29, wherein said tie members are welded to said mounting structure and to said support member.
31. A gas permeable probe in accordance with claim 29, wherein at least one of a pressure sensing line, a gas conducting line and a heater lead for a heater associated with said retroreflector extend through respective ones of said tubes.

32. A gas permeable probe for use in an optical analyzer for an exhaust gas stream flowing through a duct or chimney, the probe comprising:
- an elongate hollow structure having first and second ends and a side wall, with an optical cavity defined between said first and second ends within said side wall,
 - a mounting structure at said first end and adapted for mounting said elongate hollow structure within said duct or chimney,
 - a support member at said second end,
 - a connecting structure connecting said mounting flange at said first end to said support flange at said second end,
 - an optical window at said first end permitting a beam of light originating from an optical analyzer to enter into said optical cavity to travel from said first end to said second end,
 - a retroreflector provided at said second end for returning said light beam to said first end of said hollow structure,
 - an elongate filter module forming part of said elongate hollow structure, having first and second opposite ends and comprising a filter structure including at least one filter member and a bellows at one of said first and second opposite ends adjacent said filter structure,
 - said elongate filter module being connectable at its first end to said mounting structure and at its second end to said support member.
33. A gas permeable probe in accordance with claim 32, said mounting structure, said connecting structure and said support member forming a further module.

34. A gas permeable probe in accordance with claim 32, wherein said retroreflector, a mounting means for mounting said retroreflector on said support member and a cover are releasably mounted on a side of said support member remote from said elongate filter module.
35. A gas permeable probe in accordance with claim 32, wherein said optical window is trapped between said mounting structure and said elongate filter module by a pressure ring, said pressure ring and said optical window being removable following removal of said filter module.
36. A gas permeable probe in accordance with claim 32, having an inner tube provided within said mounting structure, said tube having first and second ends and being closed at its second end by said optical window and at its first end by a further window.
37. A gas permeable probe in accordance with claim 36, said first end of said inner tube extending beyond said mounting structure to an optical analyzer.
38. A gas permeable probe in accordance with claim 37 and further comprising a carrier tube for said optical analyzer secured to said mounting structure outside of said duct or chimney.
39. A gas permeable probe in accordance with claim 38, said carrier tube carrying a housing for equipment associated with said gas permeable probe.